Marine Physical Laboratory

MDA-1 Data Analysis and Report

William S. Hodgkiss

Supported by the
Chief of Naval Research
Contract N00014-89-D-0142 (DO#34)

Final Report

19960409 191

MPL-U-47/95
September 1995

Approved for public release; distribution is unlimited.

University of California, San Diego
Scripps Institution of Oceanography

DTIC QUALITY INSPECTED 1

REPORT DOCUMENTATION PAGE

Form Approved OMB No. 0704-0188

Public reporing burden for this collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data need ed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington Headquarters Services, Directorate for information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302, and to the Office of Management and Budget, Paperwork Reduction Project (0704-0188), Washington, DC 20503.

1. Agency Use Only (Leave Blank).

2. Report Date. September 1995

3. Report Type and Dates Covered. Final Report

4. Title and Subtitle.

MDA-1 Data Analysis and Report

5. Funding Numbers.

N00014-89-D-0142 (DO#34)

6. Author(s).

William S. Hodgkiss

Project No.
Task No.

7. Performing Monitoring Agency Names(s) and Address(es).

University of California, San Diego
Marine Physical Laboratory
Scripps Institution of Oceanography
San Diego, California 92152

8. Performing Organization Report Number.

MPL-U-47/95

9. Sponsoring/Monitoring Agency Name(s) and Address(es).

Chief of Naval Research
Department of the Navy
800 North Quincy Street
Arlington, VA 22217-5660
Code 321US

10. Sponsoring/Monitoring Agency Report Number.

11. Supplementary Notes.

12a. Distribution/Availability Statement.

Approved for public release; distribution is unlimited.

12b. Distribution Code.

13. Abstract (Maximum 200 words).

The Marine Physical Laboratory (MPL) was involved in all aspects of the July 1991 MDA-1 experiment including experiment planning, participation in the experiment, and analysis of the resulting data. Analysis of the data collected during MDA-1 began in FY92. MPL activities related to this analysis included distribution of the MDA-1 data, quick-look characterization of the data quality, localization of the MDA-1 array elements throughout the experiment and ambient noise analysis.

14. Subject Terms.

array element localization, ambient noise, signal gain degradation

15. Number of Pages. 3

16. Price Code.

17. Security Classification of Report.	18. Security Classification of This Page.	19. Security Classification of Abstract..	20. Limitation of Abstract.
Unclassified	Unclassified	Unclassified	None

MPL-U-47/95

MDA-1 Data Analysis and Report

William S. Hodgkiss

Final Report to the
Office of Naval Research
Contract N00014-89-D-0142 (DO #34)
for the Period 2-1-93 - 1-31-94

Abstract

The Marine Physical Laboratory (MPL) was involved in all aspects of the July 1991 MDA-1 experiment including experiment planning, participation in the experiment, and analysis of the resulting data. Analysis of the data collected during MDA-1 began in FY92. MPL activities related to this analysis included distribution of the MDA-1 data, quick-look characterization of the data quality, localization of the MDA-1 array elements throughout the experiment, and ambient noise analysis.

Research Objective

The objective of this work was to complete analysis of the MDA-1 data and participate in preparation of the High Gain Initiative (HGI) final report.

Research Summary

The Marine Physical Laboratory (MPL) was involved in all aspects of the July 1991 MDA-1 experiment including experiment planning, participation in the experiment, and analysis of the resulting data.

Analysis of the data collected during MDA-1 began in FY92. MPL activities related to this analysis included distribution of the MDA-1 data, quick-look characterization of the data quality, localization of the MDA-1 array elements throughout the experiment, and ambient noise analysis.

One of the major contributions of MPL to the HGI Program was in the area of array element localization (AEL). The desire to know array hydrophone positions to within a few meters accuracy motivated the use of acoustic AEL in all three of the HGI experiments. In contrast to the first two HGI experiments (SVLA and VAST) where vertical arrays were deployed from the R/P FLIP resulting in array excursions of 50-100 m over periods of several hours, the submerged tripod array deployed during the MDA-1 experiment exhibited motions of on the order of 5 m over similar time periods. Reports documenting AEL-related analysis of the VAST and MDA-1 experiments were completed during this period and include [1-4].

A second major area where MPL contributed to the HGI Program was in the short-term analysis of ambient noise. Short-term noise statistics refers to statistical characterizations over time intervals in which a single detection decision might be made. These typically would be periods from a few minutes to a few tens of minutes.

The objectives of the noise analysis were twofold. First, the desire was to ascertain the interval over which the time series at the output of individual hydrophones, conventional beams, and matched-field processor ambiguity cells are stationary. Second, for those periods when the time series can be considered stationary, the desire was to determine if the time series also can be considered Gaussian.

In general, the results of these analyses show that ambient noise during MDA-1 can be considered stationary for periods of 1/2 hour and Gaussian at the hydrophone, conventional beam, and matched-field ambiguity cell level. Furthermore, when non-stationarity or non-Gaussian character was observed, it usually could be related to spatially isolated sources of energy. Memorandums documenting the ambient noise analysis of both the VAST and MDA-1 data were completed during this period and include [5-6].

MPL participated in the planning and evaluation of a set of simulations with a focus on predicting the performance of high gain arrays substantially larger than those taken to sea during SVLA, VAST, and MDA. These simulations were carried out using an acoustic modeling

capability developed by NOSC (now NRaD/NCCOSC). The HGI Simulation was a basin scale, range-dependent, full-wavefield model which enabled exploring the trade-offs between different array geometries and processing approaches (e.g. plane wave vs. matched-field).

Lastly, MPL participated in the planning and preparation of the HGI final report. A summary of SVLA, VAST, and MDA-1 AEL results was prepared for the report and is documented in [7]. In addition, a study of signal gain degradation due to AEL errors observed in VAST and MDA-1 was carried out in support of preparing final conclusions from those experiments. This work is documented in [8].

ONR Publications

[1] D.E. Ensberg, E.D. Wolin, S. Escher, and W.S. Hodgkiss, "VAST array element localization," MPL TM-440 (MPL-U-20/94), Marine Physical Laboratory, Scripps Institution of Oceanography, San Diego, CA 92152-6400 (1994).

[2] E.D. Wolin, D.E. Ensberg, J. Murray, and W.S. Hodgkiss, "VAST AEL error analysis," MPL TM-437 (MPL-U-14/94), Marine Physical Laboratory, Scripps Institution of Oceanography, San Diego, CA 92152-6400 (1994).

[3] D.E. Ensberg, E.D. Wolin, S. Escher, and W.S. Hodgkiss, "MDA array element localization," MPL TM-434 (MPL-U-11/94), Marine Physical Laboratory, Scripps Institution of Oceanography, San Diego, CA 92152-6400 (1994).

[4] E.D. Wolin, D.E. Ensberg, S. Escher, J. Murray, and W.S. Hodgkiss, "MDA AEL error analysis," MPL TM-438 (MPL-U-15/94), Marine Physical Laboratory, Scripps Institution of Oceanography, San Diego, CA 92152-6400 (1994).

[5] J. Chang and W.S. Hodgkiss, "VAST ambient noise vertical directionality and short-term noise statistics: JD 186 and 189," MPL-U-21/94, Marine Physical Laboratory, Scripps Institution of Oceanography, San Diego, CA 92152-6400 (1994).

[6] L. Berger and W.S. Hodgkiss, "MDA-1 short-term and long-term ambient noise statistics: JD 190," MPL-U-25/94, Marine Physical Laboratory, Scripps Institution of Oceanography, San Diego, CA 92152-6400 (1994).

[7] W.S. Hodgkiss, "SVLA, VAST, and MDA-1 array element localization (AEL)," MPL-U-28/94, Marine Physical Laboratory, Scripps Institution of Oceanography, San Diego, CA 92152-6400 (1994).

[8] J. Murray and W.S. Hodgkiss, "VAST and MDA-1 signal gain degradation due to AEL errors," MPL-U-27/94, Marine Physical Laboratory, Scripps Institution of Oceanography, San Diego, CA 92152-6400 (1994).

ONR/MPL REPORT DISTRIBUTION

Chief of Naval Research (3)
Department of the Navy
Ballston Tower One
800 North Quincy Street
Arlington, VA 22217-5660
Atten:c Dr. Richard Doolittle
Code 321US

Department of the Navy (1)
Office of Naval Research
San Diego Regional Office
4520 Executive Drive, Suite 300
San Diego, CA 92121-3019

Commanding Officer (1)
Naval Research Laboratory
Atten: Code 2627
Washington, D.C. 20375-5320

Defense Technical Information Center (4)
Building 5, Cameron Station
Alexandria, VA 22304-6145